

***Bifidobacterium animalis* strain DN-173 010 shortens the colonic transit time in healthy women: a double-blind, randomized, controlled study**

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Aliment Pharmacol. Ther., 2002; 16: 587-593

Background: A previous study has suggested that *Bifidobacterium animalis* DN-173 010 shortens the colonic transit time in women. **Aim:** To confirm this effect and to determine whether modifications of the faecal bacterial mass and/or faecal secondary bile salts may be the explanation. **Methods:** A double-blind, cross-over study was performed. Thirty-six healthy women were studied in four consecutive 10-day periods. During periods 2 and 4, they ingested three 125 g cups per day of a fermented milk which was either a product containing *B. animalis* DN-173 010 or a control without bifidobacteria. Periods 1 and 3 were run-in and washout periods, respectively. The total and segmental colonic transit times were assessed using a pellet method. In 12 subjects, all stools were collected and analysed for pH, faecal weight, bacterial mass and bile acids. **Results:** The total and sigmoid transit times were significantly shorter during dosing with *B. animalis* compared to the control period. The other transit times, faecal weight, pH, bacterial mass and bile acids were not significantly affected. **Conclusions:** *B. animalis* DN-173 010 shortens the colonic transit time in healthy women. This effect is not explained by modifications of the faecal bacterial mass or secondary bile acids.

Effect of a fermented milk containing *Bifidobacterium animalis* strain DN-173 010 on the health-related quality of life and symptoms in irritable bowel syndrome in adults in primary care: a multicentre, randomized, double-blind, controlled trial

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Summary: **Background:** Health-related quality of life (HRQoL) has been rarely evaluated as a primary endpoint in the assessment of the effect of probiotics on the irritable bowel syndrome (IBS). **Aim:** To study the effects of fermented milk containing *Bifidobacterium animalis* DN-173 010 and yogurt strains on the IBS in a multicentre, double-blind, controlled trial. **Methods:** A total of 274 primary care adults with constipation-predominant IBS (Rome II) were randomized to consume for 6 weeks either the test fermented milk or a heat-treated yogurt (control). HRQoL and digestive symptoms were assessed after 3 and 6 weeks on an intention-to-treat population of 267 subjects. **Results:** The HRQoL discomfort score, the primary endpoint, improved ($p < 0.001$) in both groups at weeks 3 and 6. The responder rate for the HRQoL discomfort score was higher (65.2 vs. 47.7%, $p < 0.005$), as was the decrease in bloating score [$0.56 \pm (\text{s.d.})1.01$ vs. 0.31 ± 0.87 , $p = 0.03$], at week 3 in the test vs. the control group. In those subjects with < 3 stools/week, stool frequency increased ($p < 0.001$) over 6 weeks in the test vs. control group. **Conclusions:** This study suggests a beneficial effect of a probiotic food on discomfort HRQoL score and bloating in constipation-predominant IBS, and on stool frequency in subjects with < 3 stools/week.

Review article: Bifidobacteria as probiotic agents – physiological effects and clinical benefits

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Summary: Bifidobacteria, naturally present in the dominant colonic microbiota, represent up to 25% of the cultivable faecal bacteria in adults and 80% in infants. As probiotic agents, bifidobacteria have been studied for their efficacy in the prevention and treatment of a broad spectrum of animal and/or human gastrointestinal disorders, such as colonic transit disorders, intestinal infections, and colonic adenomas and cancer. The aim of this review is to focus on the gastrointestinal effects of bifidobacteria as probiotic agents in animal models and man. The traditional use of bifidobacteria in fermented dairy products and the GRAS ('Generally Recognised As Safe') status of certain strains attest to their safety. Some strains, especially *Bifidobacterium animalis* strain DN-173 010 which has long been used in fermented dairy products, show high gastrointestinal survival capacity and exhibit probiotic properties in the colon. Bifidobacteria are able to prevent or alleviate infectious diarrhoea through their effects on the immune system and resistance to colonization by pathogens. There is some experimental evidence that certain bifidobacteria may actually protect the host from carcinogenic activity of intestinal flora. Bifidobacteria may exert protective intestinal actions through various mechanisms, and represent promising advances in the fields of prophylaxis and therapy.

Survival of bifidobacteria ingested via fermented milk during their passage through the human small intestine: an in vivo study using intestinal perfusion

P. Pochart, P. Marteau, Y. Bounnik, I. Goderel, P. Bourlioux and JC. Rambaud
Am. J. Clin. Nutr., 1992; 55: 78-80

Abstract: The ability of a strain of *Bifidobacterium sp* to survive passage through the upper gastrointestinal tract when ingested in fermented milk was investigated in six fasting healthy adults by using *in vivo* ileal perfusion. After ingestion of $10.0 \pm 0.5 \log_{10}$ bifidobacteria in 400 g fermented milk, ileal flow of bifidobacteria increased significantly and reached a maximum of $8.8 \pm 0.2 \log_{10}$ bifidobacteria/h 1.7 ± 0.4 h after ingestion of fermented milk. The average number of bifidobacteria recovered from the terminal ileum during the 8 h after fermented-milk ingestion was $9.0 \pm 0.1 \log_{10}$ and constituted $23.5 \pm 10.4\%$ of the number ingested. These results indicate that in healthy adults *Bifidobacterium sp* survive transit through the gastrointestinal tract when ingested in fermented milk. Further studies are needed to investigate the behavior of these exogenous bacteria in the colonic lumen and to explore their effects on the physiology of the human gastrointestinal tract.

A colony immunoblotting method for quantitative detection of a *Bifidobacterium animalis* probiotic strain in human faeces

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Journal of Applied Microbiology, 2000; 88: 1019-1027

Abstract: A colony immunoblotting method has been developed to allow detection of the probiotic *Bifidobacterium animalis* strain DN-173 010 in human faecal samples. Rabbits were immunized with heat-killed DN-173 010 bacteria resulting in the production of an antiserum highly specific for bacteria belonging to *Bif. animalis* species. Of the 89 strains representative of 29 different bifidobacterial species tested, only 15 strains of the *Bif. animalis* species could be detected with the antiserum. In Western immunoblotting the serum reacts with a protein of 45-kDa apparent molecular weight. None of the bacteria classically encountered in human faecal samples and able to grow on non-selective Columbia blood agar (enterobacteria, *Bacteroides* or *Lactobacillus* for instance) reacted with the antiserum. Taking advantage of the high specificity of the antiserum and the absence of *Bif. animalis* bacteria in faeces samples of five human volunteers, we demonstrated that strain DN-173 010 survives the intestinal transit. Being based on a combination of semiselective cultivation and colony immunoblotting techniques, the method allowed detection of the *Bif. animalis* strain even when it represented only one thousandth of the total bifidobacterial population.

Isolement des Bifidobactéries dans les selles après ingestion prolongée de lait au bifidus (LB) – Recovery of bifidobacteria (Bif) in feces after prolonged digestion of bifidus milk (BM)

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Méd. Mal. Infect., 1990; hors série: 75-78 (publication in French)

Abstract: Since many authors considered that bifidobacteria (Bif) play an important role in the resistance of the colonic microflora to pathogen colonization, there has been renewed interest in the consumption of milk fermented with these bacteria (BM). However data on the survival of ingested Bif in the GIT are not yet available. Therefore, we investigated the recovery of Bif ingested in BM in the feces of 12 adults (6 men and 6 women, 17-50 yr). The experiments comprised 3 consecutive 10-day periods: baseline, the test period, and the wash-out period. During the test period subjects ingested 3 times per day 125 g BM (10^8 Bif/g) or yogurt (Y). Spores of Bacillus (SBS) were added to both fermented products (10^6 SBS/g) as a transit marker. All the subjects were tested for BM and Y in a random order. Fecal samples were obtained every 5th day and Bif were enumerated on selective medium incubated anaerobically for 5 days at 37°C and SBS on PCA agar incubated aerobically for 24 h at 65°C.

A fermented milk with a *Bifidobacterium* probiotic strain DN-173 010 shortened oro-faecal gut transit time in elderly

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Microbiological Ecology in Health and Disease, 2001; 13: 217-222

Fermented milks have been proposed to modulate gut transit time. Reduction of long transit time may be of importance in decreasing susceptibility to some large bowel diseases. *Objective*: to assess the effect on gut transit time in free-living elderly of a regular consumption of the milk fermented by the probiotic strain *Bifidobacterium animalis* DN-173 010 (10^8 CFU/g) and lactic acid cultures (10^8 CFU/g) (BM). *Design*: a randomized study was performed with 4 groups: 50 subjects with a stable transit time under 40 h (UTT : 24.6 h, SD =1.7) and 50 subjects with a stable transit time over or equal to 40 h (OTT : 64.1 h, SD = 13.3) were included. Subjects from each transit group were randomly assigned to eat during 2 weeks, either 2 or 3 servings per day of BM. The oro-faecal transit time was measured before and after BM consumption using a colored marker technique. *Results*: in the 4 groups, comparing values before and after BM consumption, the transit time reductions were statistically significant, being around 10% in UTT and around 40% in OTT ($p < 0.001$). In UTT as well as in OTT, 3 BM were more active than 2 BM ($p < 0.05$). *Conclusions*: in elderly, the long gut transit times have been shortened by a 2-week regular consumption of the milk fermented with the strain *Bifidobacterium animalis* DN-173 010 and lactic cultures. This specific fermented milk can be considered as a functional food.

Effects of consumption of a milk fermented by the probiotic strain *Bifidobacterium animalis* DN-173 010 on colonic transit time in healthy humans

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Bioscience Microflora., 2001; Vol. 20 (2), 43-48

Objectives: The aim of our study was to ascertain whether the specific *Bifidobacterium animalis* DN-173 010 fermented milk could modulate colonic transit time in humans. Bifidobacteria are a major component of the gut microflora and may interact with gut transit. Methods: The trial compared in a parallel double-blind study in seventy-two healthy volunteers the effect of a *Bifidobacterium animalis* fermented milk containing 2.6×10^8 CFU/g living bifidobacteria versus heat-treated *Bifidobacterium* fermented milk on colonic transit times. The main marker was the total colonic transit time (CTT) measured with radio-opaque pellets. Segmental colonic transit times were also calculated. Results: A 11-day consumption of this *Bifidobacterium animalis* DN-173 010 fermented milk significantly reduced the total CTT (-20.6%) comparatively to the initial CTT and to the control group where no significant change were recorded. The effect was more pronounced in women than in men. Conclusion: our study demonstrated that the consumption of the fermented milk containing living *Bifidobacterium animalis* DN-173 010 was able to improve CTT in humans.

Recent advances in the use of functional foods: effects of the commercial fermented milk with *Bifidobacterium animalis* strain DN-173 010 and yoghurt strains on gut transit time in the elderly

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Microbiological Ecology in Health and Disease, 2003; 15: 15-22

Fermented milk products containing the probiotic strain *Bifidobacterium animalis* DN-173 010 (BM), have a beneficial effect in reducing gut transit times in a range of populations including adults and the elderly, especially female. The aims of this study were to investigate the efficacy of one and two servings per day of BM in elderly subjects and to determine the duration of the reduction in transit times after stopping consumption of the product. This was a randomized, controlled and open study with four groups. 200 elderly subjects (aged 50–75 years) were enrolled in the trial. In all, one hundred subjects with medium transit times (MTT, 40–50 hr) and 100 with slow transit times (STT, >50 hr) were randomized to receive either 125 g or 250 g BM daily for 2 weeks. Oro-faecal gut transit was determined by the use of colored markers. Both dosages significantly reduced oro-faecal transit time with reductions of 20.5% and 42.2% observed in MTT subjects receiving BM 125 g/day and 250 g/day, respectively ($p < 0.0001$). Corresponding reductions in STT subjects were 27.7% and 38.1%, respectively. The beneficial effects of BM lasted long after consumption of the product was stopped, with values returning to baseline in subjects with MTT at 6 weeks follow-up and in STT subjects consuming 125 g/day BM at 4 weeks follow-up. Significant differences in transit times were still observed at week 6 of follow-up in STT subjects receiving 250 g/day BM. This study completes and confirms the dose-dependent effects of BM from 0 to 250 g per day and can be compared with similar results obtained with 250 g to 375 g per day in a previous study on transit times in elderly subjects. It also demonstrates that there are significant beneficial effects long after consumption of the product has stopped. The results suggest an important role for this probiotic dairy product in fundamentally modulating gastrointestinal function that could beneficially affect the host, and hence reduce the susceptibility to conditions associated with delayed gut transit.

***Bifidobacterium* from fermented milks: survival during gastric transit**

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J. Dairy Sci., 1991; 74: 409-413

Abstract: Two *Bifidobacterium* strains contained in two different fermented milks behave very differently when exposed to an *in vitro* simulated gastric environment. One strain survives very well during at least 90 min ($>10^7$ /g), but the second strain studied is much less resistant. These *in vitro* results, with slight differences, were confirmed by an *in vivo* study in humans. The assessment of the gastric emptying rate of these products allows an estimation of the amount of *Bifidobacterium* that may pass into the small intestine.